

**AFRICAN DEVELOPMENT BANK**

**SOCIETE ANONYME MAROCAINE DE L'INDUSTRIE DU RAFFINAGE  
MOHAMMEDIA - MOROCCO**

**SAMIR REFINERY UPGRADE PROJECT  
MOHAMMEDIA, MOROCCO**

**EXECUTIVE SUMMARY OF THE ENVIRONMENTAL  
AND SOCIAL IMPACT ASSESSMENT**

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***ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT***

**Project Name:** SAMIR Refinery Upgrade Project

**Country:** Morocco

**Project Number:** [ ]

## **1. Introduction**

1.1 The purpose of the proposed Société Anonyme Marocaine de l'Industrie du Raffinage ("SAMIR") Refinery Upgrade Project is to facilitate the production of lower sulphur content diesels and higher quality products through the installation of additional units at the existing Mohammedia refinery.

1.2 This document presents an executive summary of the Environmental and Social Impact Assessment (ESIA) prepared by Maroc Développement, for the Upgrade Project. The ESIA represents an advance assessment of the likely environmental and social impacts of the refinery upgrade and includes the opinions of the environmental authorities consulted during its preparation. Information gathered and assessed in the impact assessment process has been issued to the regional and national environmental authorities in order that they are satisfied environmental and social matters have been considered in an appropriate manner.

1.3 The ESIA comprises an Environmental Impact Assessment (EIA), a Social Impact Assessment (SIA) and an Environmental and Social Management Plan (ESMP) for the Project. The structure of this executive summary is presented in accordance with the African Development Bank (AfDB) requirements as follows:

- Project Description;
- Policy, Legal and Administrative Framework;
- Description of Project Environment;
- Project Alternatives;
- Potential Impacts and Mitigation/Enhancement Measures;
- Environmental Hazard Management;
- Monitoring Programme;
- Public Consultations and Public Disclosure;
- Complementary Initiatives;
- Conclusions; and
- References and Contacts.

## **2. Project Description/ Justification**

### Project Description

2.1 SAMIR currently operates a facility at Mohammédia, Morocco, which is capable of producing naphtha, fuel oil, liquefied petroleum gas (LPG), bitumen and other saleable materials from the refining of crude oil.

2.2 It is proposed that the refinery facility will be upgraded (i.e. the ‘Upgrade Project’) while maintaining the same crude processing capacity of 6.25 million tonnes per year. The Upgrade Project will include the installation of new equipment, which will improve the quality of certain products and enable the refinery to produce low sulphur diesels. In summary, the Upgrade Project will permit SAMIR to refine and treat products to meet increasingly stringent Moroccan and EU product specifications, serving to safeguard its future as a producer of refined crude products.

### Upgrade Project Components

2.3 The Upgrade Project will require the installation of a number of ‘process units’ to improve product quality. These can be summarised as follows:

- **Vacuum Distillation Unit** – Essentially a heater unit which separates a feed stream into different ‘fractions’ by utilising the differing boiling point ranges of the feed components;
- **Cracking units** – These units use hydrogen and a catalyst to convert certain product streams into ‘lighter’ fractions (i.e. less dense and less viscous products); and
- **Hydrotreater** – Uses hydrogen to remove sulphur from particular product streams. This system will (through other processes) lead to sulphur production at a sulphur recovery unit (SRU).

2.4 A hydrogen production unit will also be included in the Upgrade Project to meet the expected demand of the new cracking units and hydrotreater. The Upgrade Project also includes expansion of the refinery infrastructure including on and off site utilities, additional product storage and connections, or “tie-ins”, to the existing refinery.

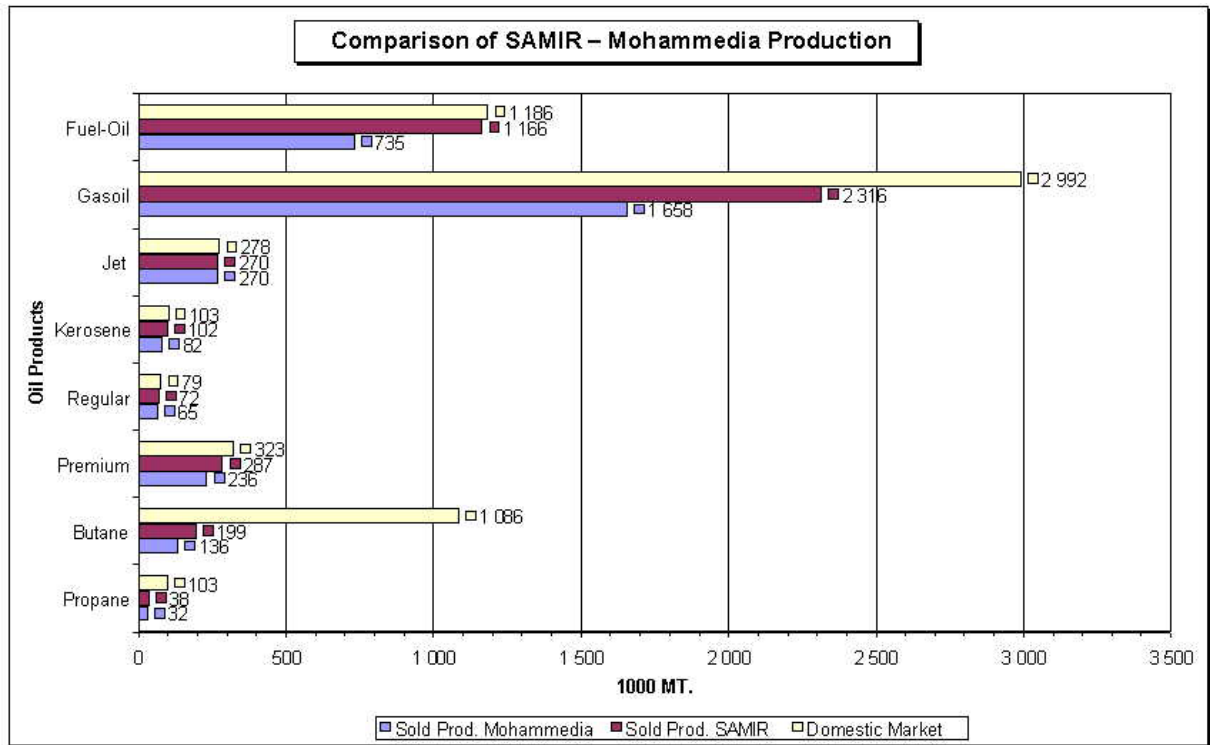
### Project Justification

2.5 The rationale for the development is two-fold:

- **Economic** - from regional and national benefits associated with increased production capacity and saleability of product streams; and
- **Environmental** - benefits associated with the significant improvement in the specification of fuels produced by the refinery. There is extensive use of SAMIR refined products domestically, and it is expected that the Upgrade Project would afford a 200-fold reduction in sulphur content of its fuel product stream. In addition, the Upgrade Project will make use of a state of art wastewater treatment plant, which will also improve the environmental performance of the existing facility.

2.6 The importance of the Mohammédia refinery nationally is demonstrated in Figure E1, which shows the extent to which the refinery fulfils the country’s petroleum product requirements.

**Figure E1: A Comparison Between SAMIR Petroleum Production and Moroccan Domestic Demand**



### 3. Policy, Legal and Administrative Framework

3.1 A wide range of national and international regulations apply to the activities associated with the Upgrade Project.

#### National Legislation/Local Regulations

3.2 Key Moroccan environmental legislation includes:

- **Draft Environmental Impact Assessment Bill** and associated decree; and
- **Law on Water** n° 10-95 (August 1995).

There is an additional and relevant law, “Loi pétrolière”, which regulates the oil sector specifically with respect to development and upgrades of refineries, oil distribution and storage facilities. However, at the time of writing, this law was not yet ratified by the Moroccan Government. Despite the status of the “Loi pétrolière”, the Upgrade Project has been designed in accordance with the provisions established therein. Another important regulation relevant to the Upgrade Project is the ‘Règlement Général Sur les Gaz de Pétrole Liquéfiés’, which regulates the storage, handling and refuelling of LPG in Morocco. This Regulation is equivalent to the French “Arrêté” (November 09, 1972) and contains standards for LPG facility design.

3.3. In May 12, 2003, Morocco ratified three laws addressing environmental matters. The Laws are:

- Law No. 11-03, No. 1-03-59, Rabii I 1424 – Protection and valorisation of the Environment;
- Law No. 12-03, No. 1-03-60, Rabii I 1424 – Environmental Impact Assessments; and
- Law No. 13-03, No. 1-03-60, Rabii I 1424 – Air Quality Pollution Control.

It should be noted that whilst Laws 11-03 and 13-03 have been ratified, limits and guidelines for releases to environmental media and environmental action levels (e.g. air quality standards) are still to be finalised and approved by the Moroccan authorities.

### International Guidelines

3.4 As a number of the Upgrade Project proponents have sought funding from International Financial Institutions (IFIs), the following guidelines are considered relevant to the project and are in line with the requirements of major lending parties:

- World Bank (WB) Gaseous Emission Limits for Refineries;
- WB Guidelines Liquid Discharge Limits for Oil Refineries; and
- WB Noise Guidelines.

In addition the World Health Organisation (WHO) air quality guidelines have been considered as internationally recognised standards for environmental protection for this project.

### European Legislation

3.5 In line with its commitment for improved environmental performance, SAMIR proposes to develop the Upgrade Project in accordance with European Design Standards (i.e. draft guidance for Mineral Oil and Gas Refineries).

## **4. Description of Project Environment**

### Site Setting and Description

4.1 The site lies approximately 65 kilometres (km) from the city of Rabat and 20 km from Casablanca. The refinery site lies close to the western edge of the town of Mohammédia on the edge of the Atlantic Ocean at 33.5°N. To the south lies the prefecture of Ben Slimane and to the West of Bernoussi-Zénata (Figure E2). The site covers a total area of 200 hectares which is bounded as follows:

- **North:** Atlantic Ocean, comprising open sandy beaches in the easternmost area and rocky coastline to the west;
- **West:** Coal-fired power station owned and operated by ONE, the state-owned utility; bulk LPG storage facility operated by Butagaz; bulk hydrocarbon product storage facility operated by [CEC];
- **South:** The main Casablanca – Rabat highway runs along the southern boundary of the site with areas of cultivated land beyond; and
- **East:** The newly constructed dyke borders the site to the east.

4.2 The El Maleh Oued rivermouth is located within approximately 1 km of the site to the northeast, midway between the refinery and the port of Mohammédia. The area surrounding the refinery is predominantly industrial in character, with only a small number of residential properties in close proximity to the site. The nearest urban centre is Ain Harrouda located 6 km to the south. A dyke to the east of the site has been constructed to protect the refinery from flooding.

**Figure E2: Location of SAMIR Refinery at Mohammédia**



### Environmental Baseline

4.3 An important aspect of the EIA process is to establish existing or pre-Upgrade Project conditions at the proposed site. This is known as an environmental baseline assessment and establishes the environmental quality of the areas affected by the Upgrade Project, including the extent to which the natural environment has historically been deteriorated.

Environmental baseline studies have been undertaken for the EIA process primarily by review of existing literature, supplemented by a number of field investigations, which include:

- Soil and groundwater;
- Air quality;
- Noise; and

- Seawater quality.

4.4 A summary of the environmental baseline for the development site is presented below:

**Table E1: Environmental Baseline**

<b>Resource</b>	<b>Pre-project condition</b>	<b>Source</b>
Soil and Groundwater	<b>Poor</b> , heavily contaminated with hydrocarbons	Field investigation
Air Quality	<b>Poor</b> , heavily impacted by industrial activities	Field investigation
Noise	<b>Good</b> , representative of an industrial area and no evidence of nuisance to nearby receptors	Field investigation
Seawater Quality	<b>Good</b> and compliant with project standards	Field investigation
Terrestrial Fauna and Flora	No known protected species or areas on or adjacent to the proposed site	Desk study

#### Socio-Economic Baseline

4.5 The region of Mohammédia has a population of approximately 232,000. Regional road, rail, telecommunication, electricity and water infrastructures are generally good and well developed. While the health system is well established it is under some pressure due to insufficient numbers of health professionals needed to care for the local community. SAMIR provides its own healthcare service and its own on-site clinic for employees.

4.6 Economic activity in Mohammédia is primarily driven by the industrial sector. The refinery itself is a significant employer in the area, directly employing approximately 1,300 people. The SAMIR refinery provides sporting facilities, a socio-cultural centre and over 1,000 residencies for its employees. SAMIR is an equal opportunity employer, hence its employees are treated without regard to their race, religion, sex, colour, age, national origin, or physical or mental ability. The oil refining industry is a male dominated sector worldwide, however it should be noted that 9% of SAMIR's employees are female.

4.7 The SAMIR refinery procures work from 220 local and regional sub-contracting companies. Imports and exports of petroleum products associated with the SAMIR refinery activities represent 87% of the total ship traffic at the Mohammédia port.

4.8 The SAMIR refinery is involved in a number of social projects with the local authorities and communities. Key current initiatives include:

- In 1999, the SAMIR refinery initiated the project "clean beaches", a project that specifically targets improvement of the condition and amenity of Mohammédia and Mannesman beaches. The key aspects of the project include regular litter collection, provision of toilets and development of signs to raise environmental and social

awareness for the coast of Mohammédia. This project represents an investment of 800,000 DH per year;

- The SAMIR refinery offers 300 work placements per year;
- The SAMIR refinery promotes and supports education in Morocco by providing funding for books, school furniture and school construction projects. The company also provides more than 1000 scholarships for children of the personnel;
- SAMIR technical experts attend vivas and other oral examinations at numerous local universities and technical institutes;
- SAMIR provides educational site visits for local schools;
- The SAMIR refinery sponsors the Mohammédia annual football tournament where typically over 1,000 players participate; and
- The SAMIR refinery also provides funding to support and promote regional cultural initiatives (Fès Saïss, Bouregrag, Carrefour, the Abderahim Bouabid Foundation, the Moroccan Union of Writers, etc.).

## 5. Project Alternatives

### No-Development Option

5.1 As demonstrated in Figure E2 the Mohammédia Refinery supplies the majority of Morocco's petroleum demands, and is a nationally important company in terms of export. In order to fulfil the state's aim that diesel products in Morocco contain no more than 50ppm sulphur, a "do nothing" alternative for this project would infer the import of low sulphur fuels. This would inevitably have a significant impact on the economic performance and operating future of SAMIR and on the export revenue of Morocco. In addition, the improvements in environmental performance of the existing refinery brought about by the Upgrade Project would not be realised by the no-development option.

### Alternative Refinery Feedstock

5.2 An alternative to the development of the refinery upgrade includes the import of a lower sulphur crude feedstock. Whilst this would allow SAMIR to meet the objective of supplying low sulphur diesel to the domestic and international markets it would have an overall detrimental impact on refinery economics. In addition the result of adopting the low sulphur feedstock alternative would be the production of excess heavy fuel oil (above market demand) and a shortage of distillate fuel products. In conclusion there would be an overall negative effect on both the economics of SAMIR and Morocco.

### Alternatives Sites

5.3 The Upgrade Project holds many synergies with, and dependencies on the existing SAMIR facility at Mohammédia. Development of the project at an alternative site would require the establishment of new facilities, utilities, and import / export infrastructure. Therefore alternative sites have not been considered in the design process of the project.

### Upgrade Project Technology Alternatives

5.4 The project proponents have conducted an exhaustive analysis of technical alternatives to meet the overriding objective of reducing sulphur content of diesel product to 50 ppm. All of the technologies used in the Upgrade Project are proven and are used in commercial operations

worldwide and will be operated in a manner that fully complies with the environmental standards set for the project.

## 6. Potential Impacts and Mitigation/Enhancement Measures

6.1 Potential environmental and social impacts have been assessed within the EIA for the each phase of the project. The most significant beneficial and adverse impacts for the construction (including site preparation) and the operational phases are detailed below.

### Construction Phase – Impacts

6.2 The types of potential impacts normally associated with construction projects and relevant to the setting and sensitivities of the project site are as follows:

- **Local air quality:** adverse impacts to air quality are expected to arise from dust, toxins originating from contaminated soils, solvent vapours and exhaust emissions from construction equipment;
- **Solid waste:** adverse impacts are expected to arise should inappropriate storage and handling of solid wastes, such as contaminated soils and scrap materials, occur;
- **Liquid waste:** an adverse impact to the littoral marine environment adjacent to the site may occur due to effluent discharge; and
- **Employment opportunities:** it is expected that there will be a beneficial impact with regard to employment in the local area. The project will create an estimated 10 million man-hours over 3 years in direct and indirect employment. An estimated 4,000 to 5,000 workers will be hired during the construction period, which represents an USD\$100-150 millions investment.
- **Temporary loss of amenity:** an adverse impact on road users is expected during the construction phase due to the import, by road, of a significant amount of equipment and materials. It is likely therefore that short-term inconveniences may be experienced by other road users especially at the point where the new site access road will intersect with the main Mohammédia-Casablanca coastal highway; and
- **Local Procurement:** a beneficial impact is expected with regard to the local economy as, during the construction programme, the procurement of goods and services from local suppliers will be required.

### Construction Phase – Mitigation Measures

6.3 The significance of the impacts noted above will be minimised or removed through the implementation of the project environmental and social management plan (ESMP). Key mitigating measures to be applied during the construction phase of the project are summarised as follows:

- **Solid waste:** a sustainable waste management approach has been adopted by the refinery and will be implemented at the site construction phase. This strategy includes waste segregation and appropriate storage in bunded tanks / areas;
- **Sanitary waste:** will be treated at the existing facility;
- **Local air quality:** where working on contaminated land, measures will be taken to reduce impact to human health;

- **Employment:** Moroccan nationals will represent 95% of the construction workforce and a worker training programme will be implemented;
- **Amenity:** project related traffic will be subject to stringent controls to minimise inconvenience to other road users; and
- **Procurement:** a procurement strategy will be developed aimed at maximising use of local suppliers.

#### Operational Phase – Impacts

6.4 The types of potential impacts normally associated with an operating refinery and relevant to the setting and sensitivities of the project site are as follows:

- **Local air quality and air emissions:** while the total emissions from the existing refinery and its Upgrade components are expected to greatly exceed the WHO air quality standards, emissions generated by the Upgrade Project in isolation are forecast to meet the standards. In addition the stack emissions of NO<sub>x</sub> and PM<sub>10</sub> originating from the Upgrade Project in isolation are forecast to meet the World Bank emission limits. An adverse impact, however, will occur in terms of sulphur dioxide (SO<sub>2</sub>) arising from combustion processes;
- **Solid waste:** adverse impacts to soil, groundwater and surface water may occur due to inappropriate storage and handling of waste;
- **Liquid waste:** adverse impact to coastal environment may occur where effluents are discharged without appropriate treatment; and
- **Employment and training:** a beneficial impact to local employment is anticipated, as 120 jobs will be created. Furthermore, the transport of sulphur from the Mohammédia Refinery to Jorf will create an additional 50 jobs. Existing and new staff to be trained in new refining technologies through technology transfers; and
- **Procurement:** the project will continue to procure services from local suppliers (e.g. collection and distribution of liquid sulphur by-product) and thereby will continue positively contribute to the local economy.

#### Operational Phase – Mitigation Measures

6.5 As noted above, the significance of these impacts will be minimised or removed through the implementation of the project ESMP. Key mitigation measures for the operating facility are as follows:

- **Local air quality and air emissions:** extensive studies considering options such as desulphurisation of crude oil, desulphurisation of fuel oils used at the refinery and flue gas desulphurisation have shown that these alternatives for lowering SO<sub>2</sub> emissions would not be economically viable due to the significant investment costs required (between US\$60 million and US\$250 million). To minimise the impact to air quality from the Upgrade Project as far economically possible state of the art low NO<sub>x</sub> technology and appropriately designed stacks will be utilised. Furthermore, future availability of natural gas as a fuel will vastly improve environmental performance in terms of air emissions and, it is anticipated, will allow all World Bank air emission standards to be met;

- **Employment:** in order to enhance the beneficial employment impact further it is proposed that a number of workers from Sid Kacem refinery (who would otherwise be facing redundancy), will be employed at Mohammédia;
- **Solid waste:** a detailed waste management plan has been developed in accordance with international guidelines; and
- **Aqueous waste:** a state of the art wastewater treatment facility will be established to treat all aqueous waste associated with the Upgrade Project and has been designed to accommodate wastewater associated with the existing refinery and the Upgrade Project operations.
- **Procurement:** the procurement strategy will be maintained and adapted as required throughout the life of the project to maximise use of the local supplier base.

## 7. Environmental Hazard Management

7.1 An important aspect of the design process is that all unplanned events, which may cause environmental damage or effect / harm people are considered fully. In some instances such analysis may lead to design or operational changes which either reduce the likelihood of the unplanned event, the magnitude (impact) of the unplanned event, or both.

7.2 The mechanism for such a risk analysis is to undertake a quantitative risk assessment (QRA). The QRA for the Upgrade Project has led to a project design basis where the risk of accidental events, which may impact the environment or people, is as low as reasonably practicable.

## 8. Monitoring Programme

8.1 Monitoring the effectiveness of mitigation measures developed during the ESIA process and the general environmental performance of the Upgrade Project is achieved through the Project ESMP. The ESMP is the mechanism for ensuring that the measures identified are implemented in an appropriate and timely manner. In addition it also provides a monitoring framework designed to demonstrate that such measures are carried out and that they are effective.

8.2 The parameters that will be monitored on a regular basis and assessed against national and international standard (as discussed above) will include:

- Air quality and stack emissions;
- Wastewater discharges;
- Groundwater;
- Seawater;
- Noise; and
- Waste management.

SAMIR will produce an annual environmental report, which will summarise the findings of each monitoring programme. Should the findings of the monitoring programme indicate non-compliance with the project standards immediate measures will be taken to remedy each issue.

## **9. Public Consultations and Public Disclosure**

SAMIR has consulted with a number of Governmental Departments and Agencies, as well as with the local municipality during the ESIA process. Their opinion regarding the scope and nature of ESIA activities has been considered and is reflected in the scope of the ESIA document. The full ESIA document will be subject to public disclosure thereby allowing interested and/or concerned parties to register their issues with SAMIR which will respond as required. The SAMIR Communications Department will receive, record and respond to any grievances throughout the construction and operational phases of the project.

## **10. Complementary Initiatives**

The most significant initiative, in terms of improvement in environmental performance, will be the use of natural gas in place of LPG/HFO currently used by heaters and boilers both at the existing refinery and within the Upgrade Project. The switch to natural gas will lead to a significant reduction of SO<sub>2</sub>, NO<sub>x</sub> and particulate matter emissions. This is expected to result in a significant improvement to the local air quality for an estimated investment cost of approximately US\$60million.

## **11. Conclusions**

11.1 The ESIA process has identified a number of environmental and social impacts associated with the construction and operation for the Upgrade Project and has established appropriate and feasible measures for their mitigation. Overall, the state of the art design basis, the ESMP and future proposals to improve environmental and social performance have led to the conclusion that the significance of the project in terms of environmental and social impact is low.

11.2 It is also anticipated that the use of the refined low sulphur fuels domestically will result in a significant improvement to air quality particularly in urban areas of Morocco. Furthermore, the Upgrade Project represents a strategically important investment for the refining industry of Morocco. Without such investment it is likely that imports of low sulphur fuels, necessary to meet the new fuel specifications are likely to significantly affect the demand for refinery products domestically and the future economic viability of the national refining industry.

11.3 The project under reference is found to be environment-friendly, economically sustainable, and socially acceptable. This executive summary is, therefore, submitted to the Board for consideration.

## 12. References and Contacts

### References

Final Environmental Impact Assessment Report issued by Maroc Développement in May 2004.  
A list of references is available in the Report.

### Contacts

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